NEW BUILDING BLOCK TECHNOLOGIES AND THE COLLABORATIVE BIOME

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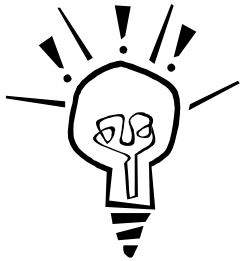
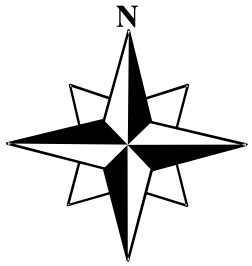
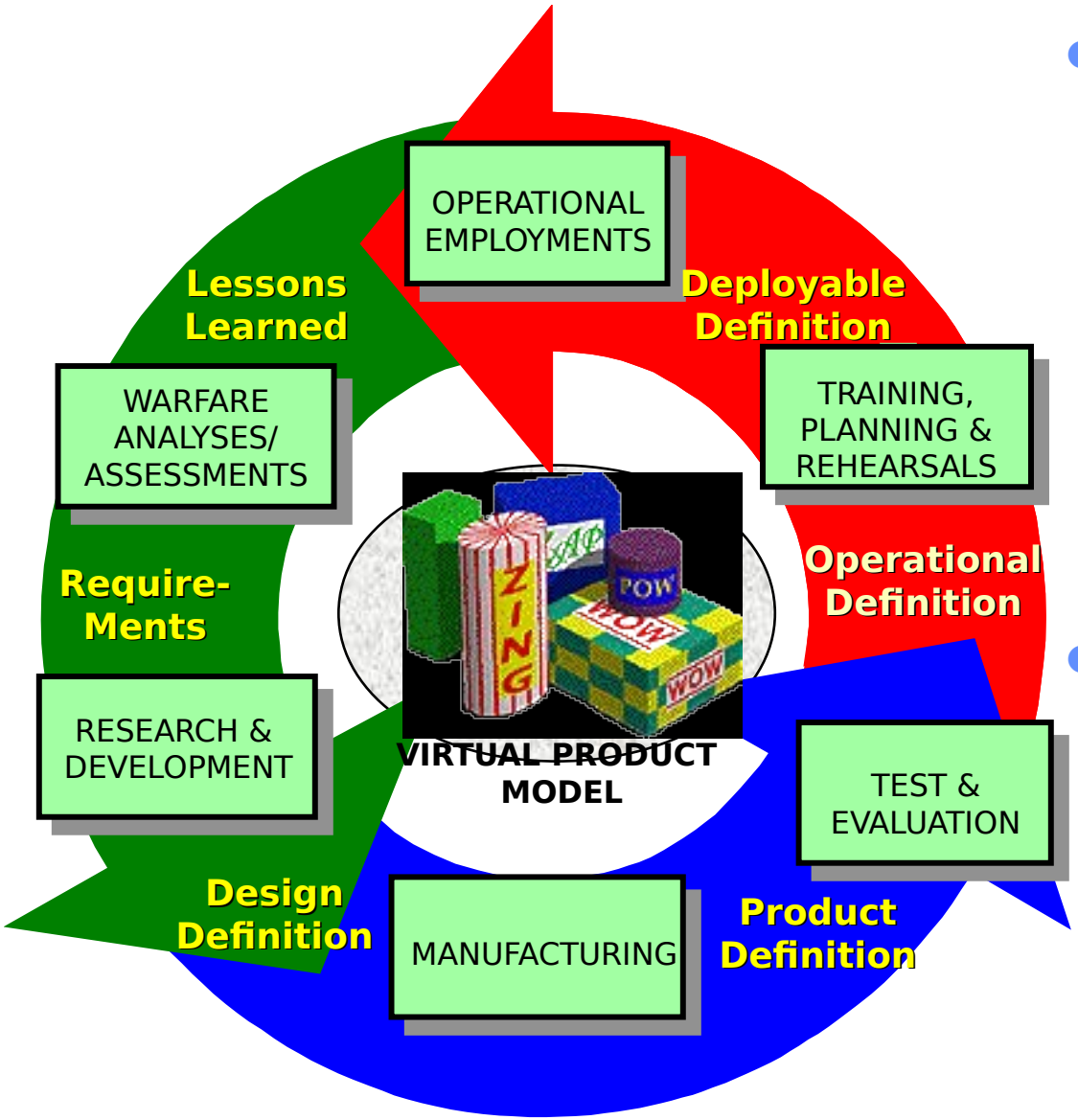
Briefing Agenda

- **Introduction**
  - Background
  - Problem Characteristics
  - SBA Architecture Vision
  - Collaborative Biomes
- **Building Block Technologies**
  - Jini Technology
  - XML Technology
  - Technology Impacts
  - Application Scenario
- **Conclusions**
  - Commercial Sector Initiatives
  - Expanding the Notion
  - Narrowing the Focus
  - Embracing the Inevitable





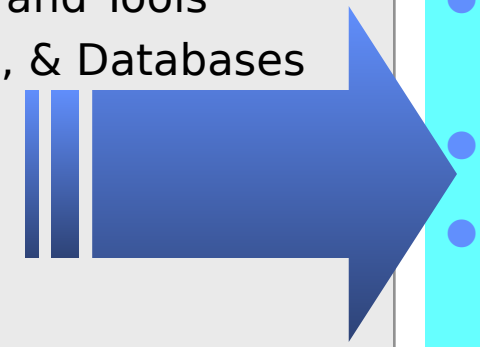
SMART Life Cycle Vision



- **Develop and operate the system in the computer**
  - **Domain and phase-specific assessments**
  - **Capitalize on M&S to collaboratively address development and cost issues between and among requirements, acquisition, and training communities**
- **Requires integration and interoperation of simulations, models, tools, utilities, applications, and databases**
  - ***Defines the problem***

Problem Characteristics

- **Integration - new/legacy software**
  - Simulations, Models, and Tools
  - Utilities, Applications, & Databases
  - Heterogeneous**6
- **Interoperation - new/legacy software**
  - Simulations, Models, and Tools
  - Utilities, Applications, & Databases
  - Heterogeneous**6
- **Distributed**
  - Developer
  - User
- **Evolving**
  - Technology
  - Requirements

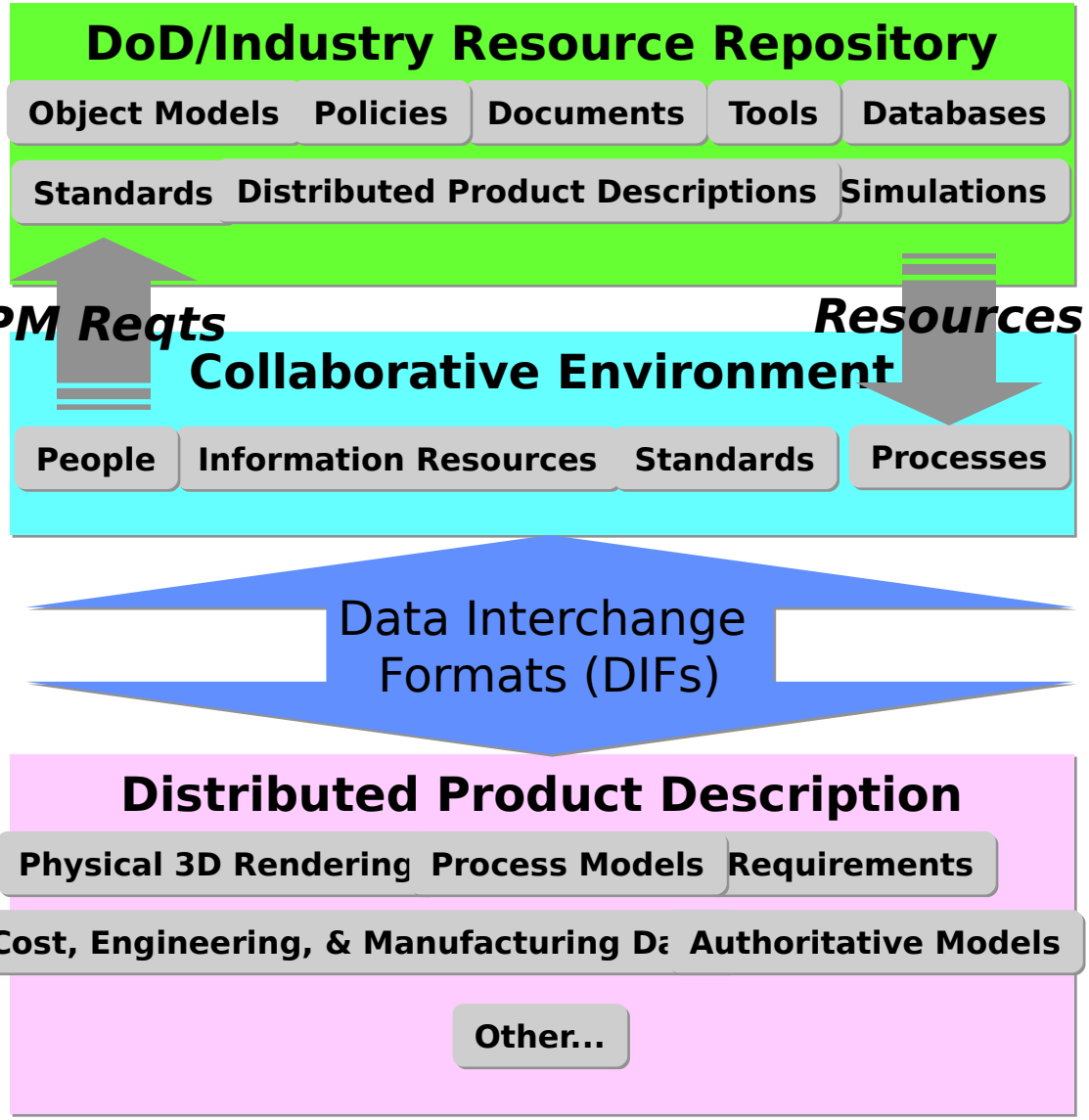


*Heterogeneous**6*

- **Platform – PC/Windows, Unix, Mac, embedded, ...**
- **Language – C/C++, Java, Ada, FORTRAN, ...**
- **Location – local vs remote**
- **Fidelity – high vs low**
- **Runtime dynamics – batch, interactive, realtime, ...**
- **Integration standards – HLA, DIS, ...**

Common characteristics drive a plug-and-play integration architecture

SBA Architecture Vision



- **DoD/Industry Resource Repository (DIRR)**
  - Distributed web-based repository
  - Union of capabilities provided by all CEs
- **Collaborative Environment**
  - Reusable framework of tools, resources, & IPTs
- **Distributed Product Descriptions (DPD)**
  - Distributed web-based product/process data/models
  - Access controlled user-selectable view

Collaborative Environment(s)

- **Q: What's Collaborative Environment?**
- **A:**
  1. A room with a whiteboard...
  2. LotusNotes and a phone...
  3. A full-blown tool for assembling/executing ad hoc simulations out of simulation building blocks...
  4. All of the above
- **There won't be one Collaborative Environment**
  - There will be multiple Collaborative Envi
    and they'll interact
    in a ***Collaborative Biome***

Buzzword Alarm

Collaborative Biome

Biome:

a complex biotic community characterized by distinctive species and maintained under climatic conditions of the region… largest ecological unit containing many interacting ecosystems …

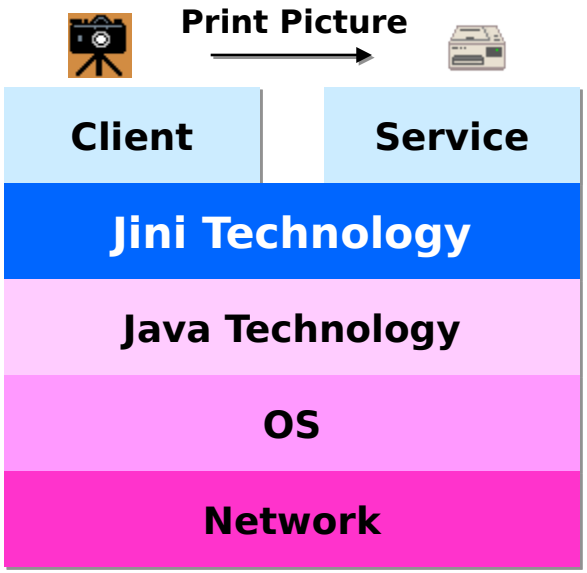
Examples: ***Tundra, Desert Scrub, Temperate Grasslands***

- **Conceptual Mapping**
  - Distinctive species => models and simulations
  - Climate => Aviation, Communication, etc.
  - Ecosystem => ACR, RDA, TEMO
- **Concept Value**
  - Identify and accept the undeniable -- *multiple, heterogeneous, interacting Collaborative Environments*
  - Identify opportunities -- *integration and interoperation infrastructure Building Block Technologies*

Commercial Sector Developments will impact Simulation Integration

Jini™ -- Spontaneous Networking

What is it? Set of Java APIs and network protocols



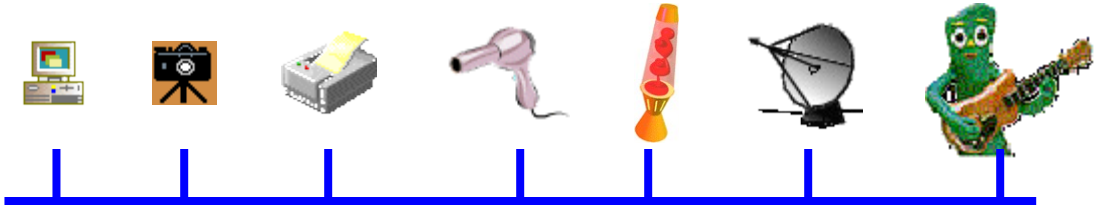
- **Creation of service federations**
  - Service is anything that can be connected to a network
  - All services are equal peers
  - All services provide mobile proxies allowing clients to use the service
- **Network-resident runtime infrastructure**
  - Find, access, add, and remove services
  - Leasing and transaction services for recovery
  - OS and network protocol independent
- **Architecture/programming model addressing a new distributed computing scenario**
  - Heterogeneous mix of networked desktop and embedded devices

Same scenario facing SBA:

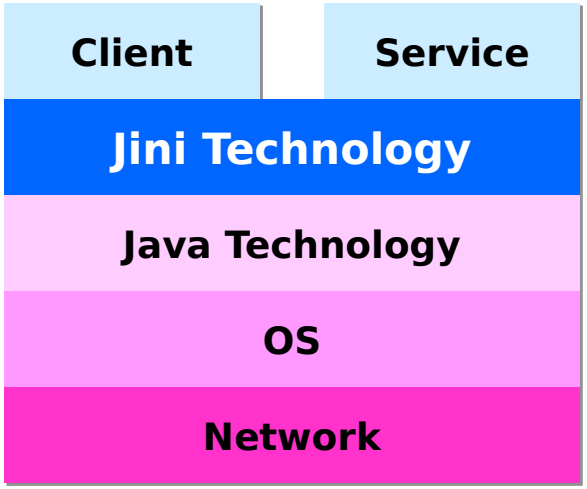
Client and service are both simulations

Jini™ -- Implications

- **Concept Focus**
  - Device Federations
  - Wireless and wired network links



- **Focus Expansion**
  - Device == simulation
    - Service Device == GPS Satellite Constellation Simulation
      - Registered via Jini LS
    - Client Device == Aircraft Simulation
      - Finds, downloads proxy via Jini LS
      - Executes service via proxy
      - Proxy hides complexity
  - Proxy == Federate Ambassador
  - Proxy Development == Challenge
    - Open-ended complexity



No magic

- ***Intuitive Concept***
- ***Clean Architecture***
- ***Industry Momentum***

XML: eXtensible Markup Language

- **Universal schema defining portable data**
  - Structure, Content, and Presentation
  - Eventual HTML replacement
- **Extensible**
  - User-defined tags
  - Domain and market-specific dialects and languages
- **Industry Interest and Momentum**
  - World Wide Web Consortium (W3C) approval
  - Microsoft, Oracle, IBM, and others adopting
- **Application Domains**
  - Data warehousing/mining
  - Electronic Data Interchange (EDI)
  - Enterprise Application Integration (E

Same domains as SBA

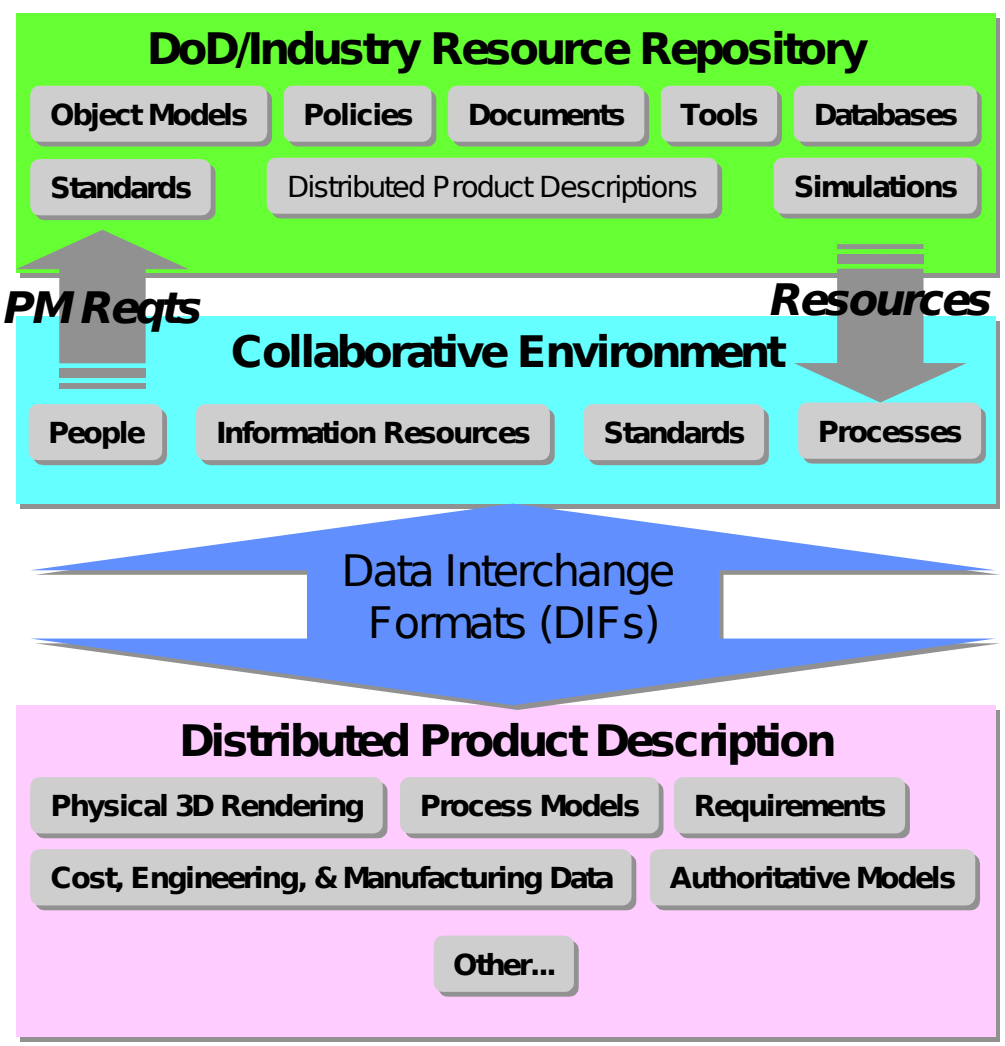
- ***Simulation integration and interoperation***

XML Impacts

- **Service Proxies == Federate Ambassadors**
  - Requirements
    - Reusable
    - Platform Independent
    - Mobile
  - Current Implementations
    - C++ executables
    - Sometimes with Ada or Java wrappers
    - Reusable but not platform-independent/mobile

- **Synergy ⇒ XML/Java Federate Ambassadors**
  - XML provides universal syntax for portable, reusable data
    - Electronic Data Interchange (EDI)
  - Java provides universal semantics for portable/mobile behavior
  - XML is both human and machine-readable/editable
    - Supports ambassador reuse and evolution

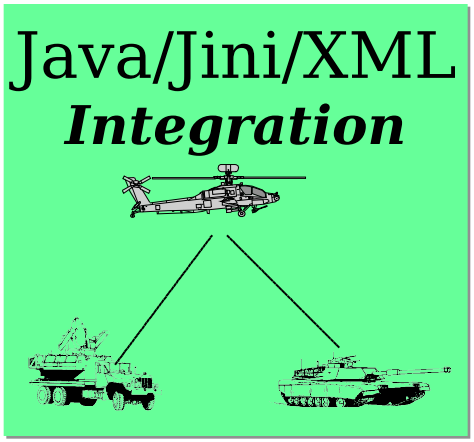
Mapping to SBA Architecture Vision



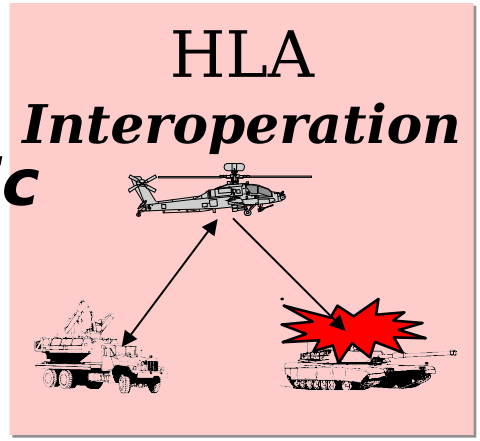
- **Services (DPDs)**
  - Portable data (XML)
  - Mobile behavior (Java)
- **Found/retrieved via Jini Lookup Service**
- **CE Extracts mobile service proxies**
  - Java objects
  - XML for proxy EDI
- **Client/Service Federate creation**

Building Block Infrastructure Approach

Static



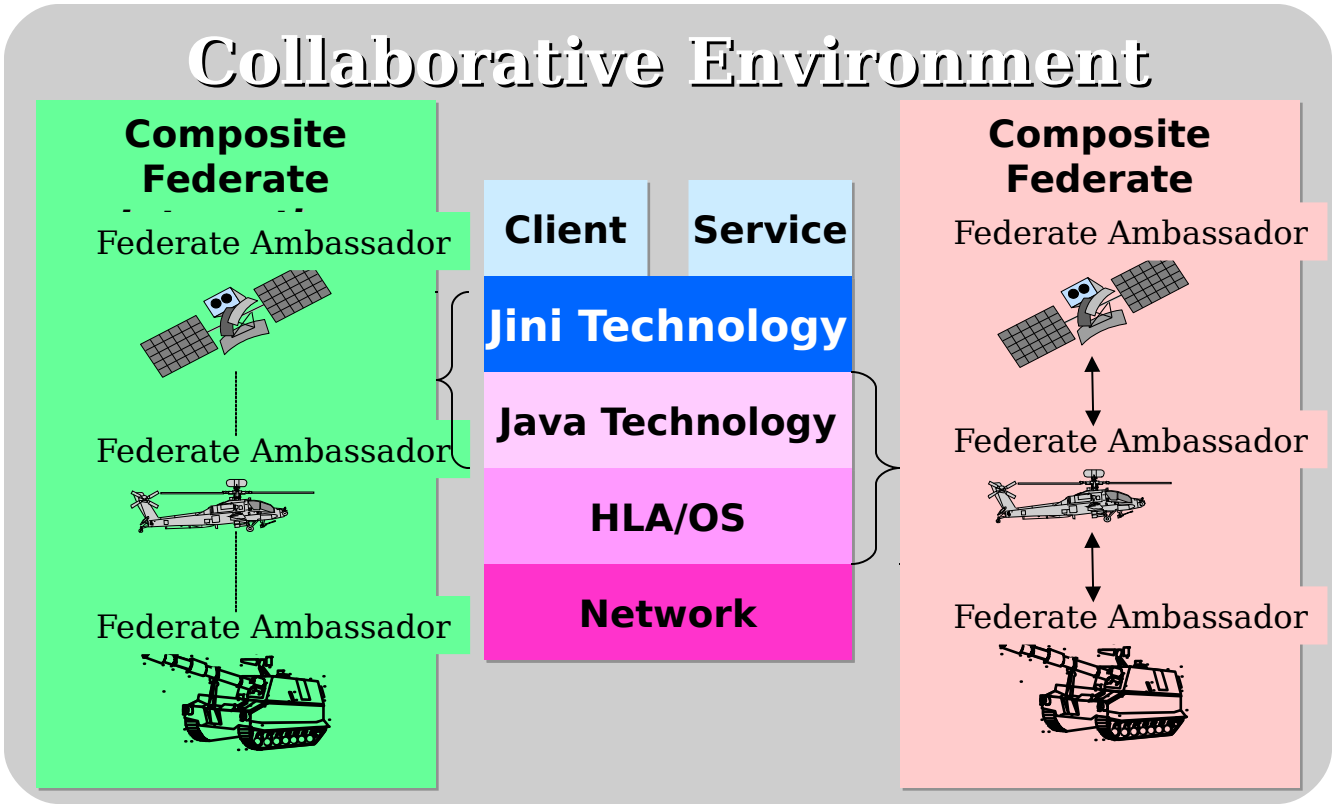
Dynamic



- **Recognize difference between Integration and Interoperation**
  - Building vs running an engine
- **Exploit commercial-sector *Integration* technologies**
  - Java, CORBA, Jini, XML
  - Proxies encapsulate underlying M&S complexity
- **Exploit HLA *Interoperation* technologies**
  - High fidelity formal semantics
  - Runtime dynamics
- **Best of both worlds building blocks**

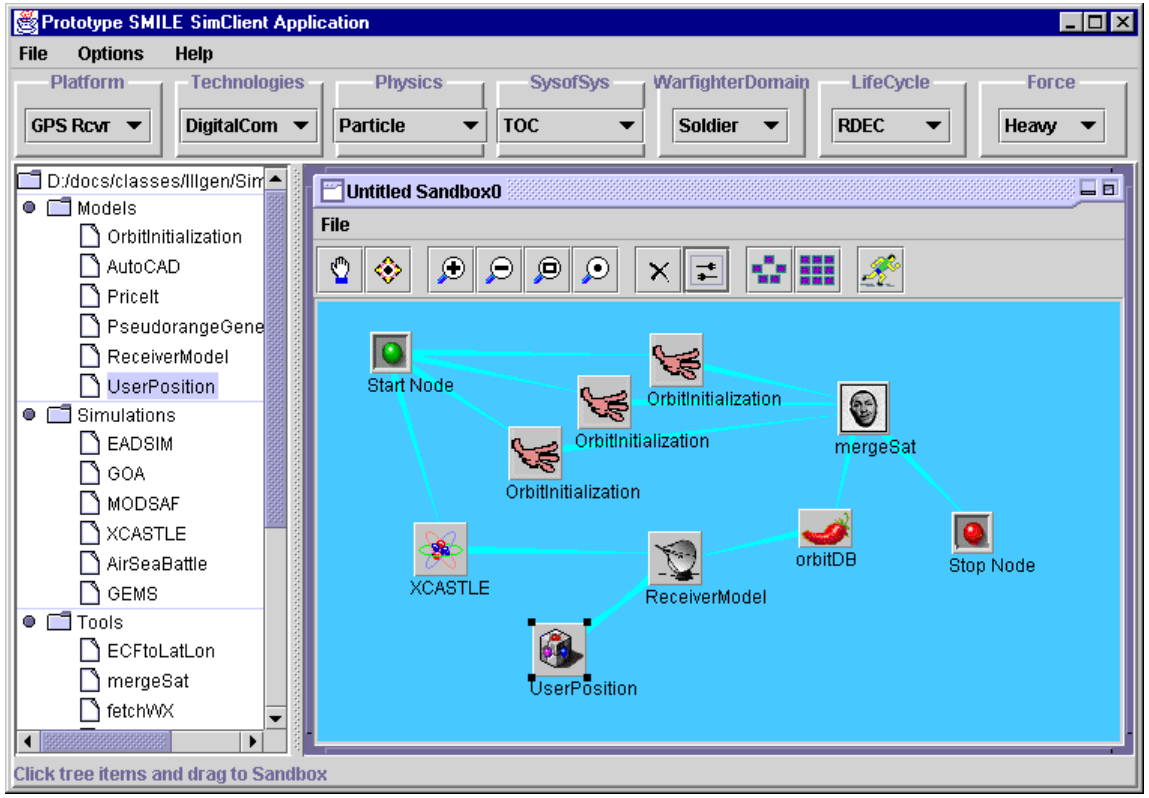
Collaborative Environment

- User view
- Bridges static integration with dynamic interoperation
- Java/Jini/XML provide connection and integration mechanism
- HLA provides interoperation and transaction mechanism



SimClient Prototype

- **Filter visibility/access to local and remote models, simulations, DBs, and tools**



- **Drag-and-drop proxies in the SimulationSandbox**
  - Define interactions
  - Specify pre/post-conditions
  - Set in/output parameters and runtime configurations
  - Run the Sandbox
  - SimulationSandbox -- as formal as an HLA Federate or as informal as an ad hoc prototype integration

Conclusion

- **Enterprise Business Applications**
  - MIS ⇒ MRP ⇒ ERP ⇒ CIS ⇒ EBA
  - Mergers & Acquisitions ⇒ EAI
- **EAI == SBA**
- ***Big Difference***
  - Solving a simpler problem
  - Spending more money

Given the BIG DIFFERENCE

- **Expand notion of a *device* to include simulation components**
- **Use commercial/enterprise sector component *integration* infrastructure**
- **Focus on technical challenge of runtime *interoperation***
  - **Proxy (Federate Ambassador) construction**
  - **Encapsulation of complexities and semantics**
  - **Manipulation in *collaborative environments***
  - **Interaction between collaborative environments -- *Collaborative Biome***

Questions

MACHINE FOR HURLING STONES.